Employee flows to study firm and employment dynamics

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Update October 2013

Abstract
Statistics on employer and job dynamics that are based on administrative firm-level data sets are overestimated due to failures in the longitudinal linking of firm records. This paper presents a method for record linking based on information on the continuity of the firm's work force. Our point of departure is a linked employer-employee data set covering the full population of Belgian employers. We describe the linkage algorithm and how it can be used to obtain more accurate statistics. We illustrate the impact of the method on measures of employer and job dynamics. The method is the result of close collaboration with the Statistics Department of the Belgian Social Security Office.

Keywords
Firm dynamics, Job creation and destruction, Linked employer-employee data, Firm-level micro data, Longitudinal record linkage

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1 Introduction

Research into the dynamics of firms and employment has received strong impetus from advances made in the accessibility of large scale administrative databases. In the past 15 years, several countries have opened up business registers, social security data, or taxation data for micro level research. Economists have taken full advantage of these empirical data to revisit classic questions and to formulate new ones.

Early studies using these data sources have revealed the large amount of labour market churning that usually remains hidden behind smooth time series of net statistics (Dunne *et al.*, 1989; Davis *et al.*, 1990, 1992, 1997; Blanchflower and Burgess, 1996). More recent work has refined our understanding of both micro-economic and macro-economic aspects of firm dynamics, job creation and destruction, and of the interaction of worker and firm characteristics (Abowd *et al.*, 1999; Foster *et al.*, 2001; Davis *et al.*, 2006; Bender *et al.*, 2008). International comparison projects have summarized some important regularities across countries (Baldwin *et al.*, 1998; Bartelsman *et al.*, 2005, 2009).

The advantages of using administrative registers for economic research are well known: compared to survey data they allow complete, or nearly complete coverage of the target population, they give access to exact estimates for detailed sub-populations, they are cost-effective, and reduce the response burden on businesses (Vale, 2003). However, these sources also have some drawbacks which stem from the fact that the data have not been collected for the purpose of economic analysis.

In this paper, we address one of the major problems arising from the use of administrative data for the study of labour market dynamics, i.e. biases in dynamics measures that are caused by failures in the longitudinal linking of firm records. The problem is due to the fact that a modification in the administrative registration of a firm does not always correspond to a 'real' economic change and vice versa. When, for example, a firm changes its identification code for tax or liability reasons, this event is recorded as the entrant and exit of a firm, which results in an upward bias in firm and employment dynamics. Also changes in firm structure, such as split-ups, mergers and acquisitions, are difficult to identify on the basis of administrative data, and likewise result in inaccuracies in dynamics measures.

Collaboration between official data providers and researchers has led to better understanding of these problems and to the development of methods for improved use of the data. Commonly applied methods to address longitudinal linkage problems rely on probabilistic matching techniques. More recently, alternative linkage methods are being explored which make use of information on employee flows between firms. These methods are in an experimental stage but yield promising results: the main advantages are that the results are easily reproducible and,

even more important, that these methods allow the observation of changes in firm structure that correspond to real economic events. Linkage methods based on employee flows require linked-employer employee data (LEED). In such data sets, both firms and employees are uniquely identified, and their relationship is followed over time.

This paper contributes to the latter approach by presenting a method for establishing longitudinal firm linkages using employee flow information. The main advantage of the method is the identification of start-ups, exits, and surviving firms which closely corresponds to economic reality. The method also allows the generation of more accurate statistics on job creation and destruction of the firms involved.

The aim of this paper is to demonstrate that a substantial quality improvement of statistics on labour market dynamics can be reached by using simple criteria. We illustrate this by showing the impact of the method on commonly used measures of firm and employment dynamics.

This paper is the result of close collaboration between the statistics department of the Belgian National Social Security Office and the research institute CES at Katholieke Universiteit Leuven. The results are based on a linked employer-employee data set and covers all private employment in Belgium.

The rest of paper is structured as follows. Section 2 defines the problem and gives a brief overview of existing methods of linking firm identifiers. Section 3 presents the data and the definitions we use. Section 4 describes the algorithm that was applied to establish longitudinal links between firm records, and the decision rules that were implemented to distinguish between spurious and real start-ups and exits. In Section 5 we discuss the impact of the method on common measures of firm and employment dynamics and in Section 6 we present some results. Section 7 discusses the weakness of the method and proposes further elaborations. Section 8 concludes the paper.

2 Longitudinal linking of firm level information

2.1 Failures in longitudinal linking

Most administrative registers used in labour market research consist of cross-sectional micro data providing detailed information on firms and employment. Individual firms in these data sets are usually identified by a unique identification code, such as the business registration number, which allows longitudinal linking of the cross-sectional information. The data are integrated into large-scale panel data sets by linking information along the firm dimension. This allows the study of trends and behaviour of firms over time.

Longitudinal linking of firm level data fails when an individual firm changes identification number or when several firms are involved in a merger, split-up or another form of restructuring. As several authors have pointed out, this introduces an upward bias in measures of firm dynamics and of job creation and destruction (Spletzer, 1998; Brandt, 2004; Abowd and Vilhuber, 2005).

The first problem, a change in identification number, may arise in case of a change of ownership or legal form (Vilhuber, 2009; Baldwin *et al.*, 2002). Also tax reasons and limitation of liability may induce a company to administratively close the firm and continue its activities under a newly registered business number. In the data set, this event emerges as following: the disappearance of the previous identification number is recorded as a firm exit - and subsequent destruction of jobs - and the appearance of a new ID is classified as an entrant - with subsequent job creation. According to internationally harmonized definitions on business demography, however, the two firms have to be considered as economically identical (see next section). No 'real' employer start-up or exit has take place, neither has any employment been destroyed or newly created. Such linkage failure thus leads to an overestimation in statistics of firm and employment dynamics.

The second problem arises when more than one firm is involved in a restructuring. This occurs when several firms are merged into one, or when a firm is split-up into multiple ones. Consider an example of the many-to-one case, which happens in case of a merger, an acquisition, or more generally a 'consolidation' (Pinkston and Spletzer, 2002). Here, at least one of the existing business numbers disappears from the data set, which is then classified as a firm exit involving job destruction. The successor firm, absorbing the jobs of the previous ones, is classified as an expanding firm creating a certain number of jobs at ones. Although the transfer of jobs in case of mergers and acquisitions is an economically significant event, it is generally accepted that it should not be included in measures of job creation and destruction (Persson, 1999; Baldwin *et al.*, 2002; Eurostat, 2003; Benedetto *et al.*, 2007; Ahmad, 2008). This means that failing to link the records of these firms induces an upward bias in job flow measures. The opposite 'one-to-many' event, which occurs in the case of a split-up or a break-up, similarly results in inaccurate measures of firm and employment dynamics.

2.2 Matching based on partial firm identifiers

The first longitudinal linkage problem, caused by changes in firm identifiers, is well understood and has been tackled by a variety of methods. Most commonly adopted methods rely on probabilistic matching: similarities in partial firm identifiers, such as name, address, or sector, are used to establish probable links between records of the same firm (Eurostat/OECD, 2007;

Robertson *et al.,* 1997; Abowd and Vilhuber, 2005). These matching processes, implemented by software, are usually complemented by clerical review to validate links or to revise uncertain matches (Eurostat/OECD, 2007, p. 36).

The second problem, occurring when multiple firms are involved in a restructuring, is more difficult to address. Most of the existing linkage methods are not able to fully capture events such as mergers, takeovers, split-offs, and other forms of restructuring. Furthermore, calculating accurate job creation and destruction statistics of firms in restructuring causes additional difficulties (Pinkston and Spletzer, 2004; Eurostat/OECD, 2007, p. 26; Ahmad, 2008, p. 132). This is where the need for an alternative approach comes in.

2.3 Matching based on employee flows

Linkage methods based on probabilistic matching make use of information on the continuity of controlling legal unit (name), activity (sector), and/or location (address) to establish links between unmatched records of the same firm. It may be somewhat surprising that these methods do not take into account continuity of one of the main production factors, i.e. the work force. This may be due to limitations of the data. If, however, the data set contains linked employer-employee information, data on employee flows can be used to fill the gap.

The idea of the employee flow method is the following: if firm *A* at time *t-1* and firm *B* at time *t* employ (partially) the same work force, then *A* and *B* relate to (parts of) the same firm. Hence, continuity of the production factor labour is used as the main criterion to establish a link between unmatched records of the same, or parts of the same firm. Technically, this is observed in the data set as a 'flow of a cluster of employees' from firm record *A*, at time *t-1*, to firm record *B*, at time *t*. The idea is formally expressed as follows:

> "if one of the main factors of production, the work force, is (partly) identical in two administrative records at two consecutive points in time, there is a high probability that these records relate to (parts of) the same firm."

A similar definition of firm continuity can be found in Eurostat/OECD (2007, p. 26), Benedetto *et al.* (2007, p. 6), and Ahmad (2008, p. 132). It is immediately clear that the decision to establish a link between firm records primarily depends on the minimum size that is imposed on the identical cluster of employees: a small minimum size will link many firms, whereas a large one will link only a few. This will be discussed below.

Several countries have started to use employee flows to provide more reliable statistics on firm and employment dynamics (Persson, 1999; Korkeamäki and Kyyrä, 2000; Baldwin *et al.,* 2002;

Mikkelson *et al.*, 2006; Benedetto *et al.,* 2007; Hethey and Schmieder, 2010). Vilhuber (2009) provides an overview of current approaches. In most studies, the employee flow approach is applied in order to remove spurious start-ups and exits from statistics on firm demography. Sometimes, it is also used to adjust measures of job creation and destruction, or to identify changes in firm structure. In this paper we address the three issues. First, we describe how we link firm ID numbers by making use of information on clustered employee flows. This allows a distinction to be made between 'real' employer start-ups and exits, and other demographic events, such as changes in business numbers and firm restructurings. Next, we describe how to adjust measures of job creation and destruction of the firms involved. Finally, we show how the established links between firm IDs can be used to identify of various types of firm restructuring.

3 Data and definitions

3.1 Linked employer-employee data set

This study relies on a linked employer-employee data set which is maintained by the Belgian National Social Security Office (NSSO). Every quarter, NSSO collects employer and employee social contributions, which are filled out electronically by the employer. In the data set, both employers and employees are recorded by means of a unique identification number. The electronic declarations ensure continuity of the employer identification, and make the data unlikely to be contaminated by measurement error.

The NSSO data set covers 99% of Belgian employers and 90% of total employment. All private and part of public employment is covered. Local public employers are not included.

The statistical units and indicators we use in this study are developed to meet international standard definitions. This enables future incorporation of Belgian results in comparative research. For the main units of analysis - active employers, and employer start-ups and exits - we have followed the joint Eurostat and OECD recommendations on business demography data collection (Eurostat / OECD, 2007; Ahmad, 2008). For indicators on job creation and destruction, we have adopted the standard definitions proposed by Davis *et al.* (1997). The definitions will only be given briefly below. For detail and motivation, we refer to the cited literature.

3.2 Start-up and exit of employer firms

The central unit of analysis is the employer firm, which are firms hiring at least one employee. In this paper, we treat the terms 'employer', 'firm', and 'employer firm' as synonyms. Firms without employees are not considered in the analysis.

An 'employer firm' corresponds with the statistical unit of the 'enterprise' recommended by Eurostat and OECD for business demography data collection: it is an organizational unit producing goods or services, with a certain degree of autonomy in decision-making, and which carries out activities at one or more locations (Eurostat / OECD, 2007). In other words, an employer firm may have more than one establishment.

A start-up coincides with a new employer firm "creating new production factors, in particular new jobs" (Eurostat/OECD, 2007, p. 34). This seemingly straightforward definition poses an important challenge for researchers using administrative data, since it implies that not all administrative entrants should be considered as start-ups, but only the ones that create new production factors, in particular new jobs. In other words, entrants resulting from a mere transfer of existing production factors a new business number should not be considered as employer start-ups. More explicitly, Eurostat/OECD (2007) recommends that start-ups "do not include entries into the population due to mergers, break-ups, split-offs or restructuring of a set of enterprises, neither do they include entries which are merely the result of a change of name, ownership, legal form, or activity". Besides this, also reactivations of 'dormant' employers (employers without employees during one or more years but a positive number of employees before and after) should not be considered as start-ups. The definition of a firm exit mirrors that of a start-up: it coincides with the "dissolution of a combination of production factors with the restriction that no other enterprises are involved in the event".

In the approach presented in this paper, we identify administrative entrants (or exits) by a mere quantitative criterion, selecting all firms which move above (or below) the threshold of one employee for the first (or last) time in the administrative data set. We then use the employee flow method to identify *real* employer start-ups that correspond to the definition above. Other entrants, emerging from a mere transfer of existing production factors a new business number, are labelled as *spurious* entrants.

3.3 Jobs

A job is an employment position held by one employee in one firm. Therefore, 'job' and 'employee' are treated as synonyms in this paper. Quarterly employment at the firm level is measured as the total number of employees on the last day of the quarter. Annual employment

at the firm level is measured as the number of employees on the last day of the second quarter (June 30).

Because the quality of job flow measures depends on the correct identification of start-ups and exits, job creation and destruction will be estimated at the firm level. Here our approach differs from what is common in large countries such as the U.S., where job flow statistics are computed using establishment data. In smaller countries like the European ones, there is considerable mobility of employees between establishments of the same firm, which would falsely be considered as job creation and destruction in an establishment approach. Furthermore, the use of firm level data enhances European comparative research since there is important variation in the definition of establishments across countries (Messina and Vallanti, 2007). In smaller countries, the vast majority of firms (90% in Belgium) only have one establishment and thus firms and establishments align (Ahmad, 2008, p. 128).

We adopt the standard definitions for measuring job creation and destruction Davis *et al.* (1997) proposed in their research on U.S. manufacturing data. (Gross) job creation at time t equals employment gains summed over all firms that expand or start-up between $t-1$ and t, and (gross) job destruction equals employment losses summed over all firms that contract or shut down between $t-1$ and t. Total job reallocation can then be measured as the sum of job creation and destruction, while net employment change is the difference between the two. In this paper we use annual employment changes to estimate job flow measures.

To compare levels of job reallocation across countries, sectors, or other subsets, normalized rates of job creation and destruction are used. Job creation (or destruction) rates between $t-1$ and t in a subset of firms are calculated by dividing total job creation (or destruction) by the average of total employment in year $t-1$ and t in the subset. The averaging of the denominator over two periods results in job flow rates ranging from -2.0 to $+2.0$, reflecting creation and destruction symmetrically. Job reallocation and net growth rates are calculated using the same denominator.

We finally remark that measures of (gross) job creation and destruction correspond to aggregate net employment changes at the firm level. In other words, these measures do not reflect the creation and destruction of jobs within firms, for example when jobs are destroyed at shrinking plants and created at expanding plants of the same firm. Job reallocation has also to be considered as the lower bound of worker reallocation, which reflects the total number of persons who change employer or make a transition from employment to non-employment, or vice versa.

4 Employee flows to link longitudinal data of firms

This section presents the different steps in the longitudinal linkage process. As explained before, the basic idea is that an employer firm is considered as continuing when it uses largely the same factors of production at two points in time.

4.1 Linking firm records by using employee flows

Longitudinal linkage methods based on employee flows generally follow the same basic design: if a significant number (or significant fraction) of employees 'moves' from one firm ID number to another in two consecutive periods of time, then a relationship between a 'predecessor' and a 'successor' firm can be established.

The point of departure of the linkage process presented in this paper are the quarterly micro data sets of all labour relations collected by the Belgian NSSO. They contain over 3 million observations every quarter, which each represent an employer-employee link. The linkage process consists of two steps. The first step is to compare all employer-employee links of two successive quarters. The links are classified into the following groups: continued employer-employee relationships, employees changing employer, and employees without an employer link in the first or second quarter. For the sake of clarity, we abstract in this description from more complex situations, such as employees that are linked to several employers in one quarter.

In a second step, the employer-employee links of step one are aggregated at the employer level. Here, a distinction can be made between five classes of employees. For each employer *A* and for every pair of quarters *q1* and *q2*, employees are classified into (1) employees staying at employer *A* in both quarters, (2) employees employed by *A* in *q1* and by another employer in *q2*, (3) employees employed by *A* in *q1* and not in NSSO employment in *q2*, (4) employees employed by another employer in *q1* and by *A* in *q2*, and (5) employees not in NSSO employment in *q1* and employed by *A* in *q2*. For employees changing employer, the ID of the previous or the next employer is retained from step one. Table A.1 in annex shows a hypothetical example.

The subsets (2) and (4), containing employees changing employer, are of specific interest to us: they allow a distinction to be made between individual employees changing employer and 'clustered employee flows' between firms. When, for a given pair of quarters, only a small number of employees moves between employer *A* and employer *B*, this is considered as individual mobility of employees simply changing jobs. When, however, a 'significant cluster' of employees makes a transition between *A* en *B*, it is regarded as an indication of a (structural) link between *A* en *B*. This is the basis for the establishment of a link between the records of a 'predecessor' and a 'successor' firm.

In the next section, we discuss the decisions rules that are implemented to identify 'significant clusters' of employee flows.

4.2 Significant clusters of employee flows

The continuity of (part of) the work force between a predecessor and successor firm gives a strong indication that they relate to the same, or parts of the same firm. The predecessor and successor might be one and the same firm that changed its identification number, or they might be different firms involved in a restructuring event such as a split-up or merger.

What the minimum 'significant' size of the cluster of employees should be in order to establish a link between such a predecessor and successor firm is, however, the subject of academic discussion. Depending on the aim of the study, different relative or absolute thresholds are proposed. The drawback of a low cut-off level is that it risks including a considerable amount of individual mobility of employees who are simply making a transition from one employer to another. A high threshold, on the other hand, risks failing to capture restructuring events involving small firms. 'Significant' clusters corresponding to relative minimum levels between 20% and 80% of the firm's work force are used, as well as absolute cut-off levels or a combination of both (see e.g. Albaek and Sorensen, 1998; Persson, 1999; Korkeamäki and Kyyrä, 2000; Benedetto *et al.*, 2007; Vilhuber, 2009; Hethey & Schmieder, 2010). It is reasonable to assume that small transitions are mainly the result of individual job mobility, whereas large transitions principally refer to changes in firm structure or identifier.

In our approach, we start with a data set containing all transitions of at least 5 employees from one firm in quarter *t-1* to another firm in quarter *t*. These are considered as candidates for a 'significant cluster' between a predecessor and a successor. Below the threshold of 5 employees, we believe there is a high probability of individual employee mobility. Next, three criteria are used to establish a link between a predecessor and a successor: 1) the relative size of the cluster of employees involved, 2) the absolute size of the cluster, and 3) whether the predecessor and successor are start-up, exit or continuing firms.

The main relative threshold to identify a 'significant' employee flow is a direct application of our definition of firm continuity presented in section 2.3: if more than half of the work force of a predecessor and a successor is the same, they are considered as (parts of) the same firm and a link is established between them. When two firms merge into one or one firm is split up, however, the employee flow usually involves a smaller part of a larger firm, and additional thresholds are imposed to allow links between the firms (see next section). Finally, if the cluster exceeds 30 employees, a link between the predecessor and successor is unconditionally established, except when the link is removed after clerical review.

While the relative thresholds we use are motivated by theoretical arguments, absolute thresholds can only be based on an evaluation of the data. In order to establish these, we manually inspected a large number of individual cases by comparing name, location and sector of the firms involved. The chosen absolute thresholds seem to us the best general cut-off levels to distinguish interlinked firm records from employee flows caused by individual mobility of workers. Setting overall cut-off levels however will, inevitably, always involve some degree of arbitrariness. This can only be overcome by complementing the employee flow method with other methods for record linking.

4.3 Decision rules for record linking

Table 1 provides an overview of the decision rules for record linking based on clusters of employee flows.

The following definitions apply:

- 'total cluster': firms which are interlinked by flows of at least 5 employees in one period (quarter *q-1* - quarter *q*) are collapsed into one 'event'; all employees of a predecessor moving to one or more successors are summed up in a 'total cluster' and so are all employees moving from one or more predecessors to a successor. The relative cut-off levels are based on the share of this total cluster in the total number of employees of the predecessor in quarter *q-1* and of the successor in quarter *q* respectively. For example, if 10 employees of firm A and 20 employees of firm B move to firm C in period (quarter *q-1* - quarter *q*), then an event X is created, comprising the three firms; the 'total cluster' at the level of the successor consists of 30 employees.
- A predecessor exits when it has a positive number of employees in quarter *q-1* and zero employees in the next 4 quarters. In order to capture also 'economic' exits where a few employees are left in place to finalize the administrative details, following situations are considered as exits as well: predecessors with a positive number of employees in quarter *q-1,*with less than 5 employees in quarters *q, q+1, q+2,* the average of these three quarters does not exceed 10% of the number of employees in quarter *q-1*, and the firm has zero employees in quarter *q*+3.
- A successor enters when it has a positive number of employees in quarter *q* and zero employees in the previous 4 quarters. Analogous to exits, 'economic' entrants after an administrative start are also considered as entrants: these are successors with a positive number of employees in quarter *q*, with less than 5 employees in quarters *q-1, q-2, q-3*, the average of these three quarters not exceeding 10% of the number of employees in quarter *q*, and the has zero employees in quarter *q-4*.
- A firm is continuing when it is neither an entrant nor an exit.

Table 1 Decision rules for record linking based on clusters of employee flows

1-2. Predecessor exits and successor enters. Or predecessor and successor are both continuing

share of total cluster in predecessor	*share of total cluster in successor*			
	0-25 %	26-50 %	51-75 %	75-100 %
0-25 %				
26-50 %				
51-75 %				
75-100 %				

3. Predecessor is continuing and successor enters

share of total cluster in predecessor	*share of total cluster in successor*			
	0-25 %	26-50 %	51-75 %	75-100 %
0-25 %				
26-50 %				
51-75 %				
75-100 %				

4. Predecessor exits and successor is continuing

share of total cluster in predecessor	*share of total cluster in successor*			
	0-25 %	26-50 %	51-75 %	75-100 %
0-25 %				
26-50 %				
51-75 %				
75-100 %				

Legend:

Predecessor and successor are linked

Predecessor and successor are linked if cluster >= 10 employees

Predecessor and successor are linked if cluster >= 30 employees

The decisions rules presented in Table 1 can be summarized as follows:

1. The records of a predecessor that exits and a successor that enters are linked when at least half of their work forces are identical: an employee cluster exceeding 50% of the work force of the predecessor in quarter *q-1*, moves to a new entrant in quarter *q* where it again represents at least 50% of the work force. Such links mainly correspond to firm ID changes.
2. If both the predecessor and the successor are active employers in the two successive quarters, the same decision rule applies. This situation occurs for example when employees are administratively reshuffled between two separately registered ID numbers of the same firm, or when a firm establishes a new separate entity into which employees are transferred in different periods

3. An employee flow between a continuing predecessor and a new entrant is an indication of a split-up. The link condition that at least 50% of the work force of the new entrant must have been employed by the predecessor is maintained, but to capture also events in which a smaller part of the firm is split-off, the threshold of 50% of the predecessor is abandoned in two cases: first, when at least 75% of the work force of the new entrant was previously employed by the predecessor firm, and second, when only 50% to 75% of the work force of the new entrant was employed by the predecessor and the minimum size of the cluster is at least 10 employees.
4. An employee flow between a predecessor that exits and a continuing successor is an indication of a take-over. The link conditions mirror case 3: the usual link condition applies that at least 50% of the work force of the exiting firm must be employed by the successor in the next quarter. Yet to capture also take-overs of small firms by larger ones, the threshold of 50% of the successor is abandoned in two cases: first, when at least 75% of the work force of the predecessor is taken-over by the successor, and second, when only 50% to 75% is taken over and the minimum size of the cluster is at least 10 employees.
5. Predecessors and successors are always linked when the cluster contains 30 or more employees.

Table A.2 in annex provides an overview of the number record linkages on the basis of the presented method in 20 quarters of observation (2005q2 to 2010q2). The results are aggregated at an annual level. Each year, about 1800 record linkages are established. ID-changes are the most common events (44% of all links), followed by take-overs (32%) and split-ups (20%). The links involve about 3100 individual firms every year. They represent only 1.4 per cent of all active firms, but as will be illustrated below, have a strong impact on measures of firm and employment dynamics.

5. Applications

Once predecessor-successor links have been established, the dataset is in a much better shape for micro level and time series analysis. We discuss the impact of the record linking method on three statistics of labour market dynamics: employer start-ups and exits, job creation and destruction, and types of firm restructuring.

As discussed in section 2, failures in the longitudinal linking of firm records induce an upward bias in measures of firm and employment dynamics. Table 2 illustrates two examples.

Table 2 Examples of registered versus real dynamics

	Number of jobs quarter q-1	Number of jobs quarter q	Registered dynamics Start-up	Registered dynamics Exit	Registered dynamics Job creation	Registered dynamics Job destruct	Real dynamics Start-up	Real dynamics Exit	Real dynamics Job creation	Real dynamics Job destruct
Firm A changes identification number										
Nr. 01	50	0	0	1	0	50	0	0	0	0
Nr. 02	0	50	1	0	50	0	0	0	0	0
Firm B is taken-over by firm C										
Nr. 03	20	0	0	1	0	20	0	Takeover	0	0
Nr. 04	100	130	0	0	30	0	0	0	10	0

If firm A, with 50 employees, changes identification number Nr.01 into Nr.02, it is recorded in the administrative data as an exit involving the destruction of 50 jobs and a start-up, creating 50 jobs, while in reality, no firm and employment dynamics took place. In the second example, firm B, with identifier Nr.03 and 20 employees, is taken over by firm C, with ID Nr.04. Again, registered dynamics overestimate real dynamics, and moreover, they do not capture the take-over.

After the records of the firms involved are linked, it is possible to compute measures of firm and employment dynamics that more accurately reflect real dynamics. A technical help to obtain these adjusted measures is the construction of 'events': predecessors and successors linked together in one period are collapsed into one 'event', which is assigned a unique event identification number. The dynamics are computed at the level of this aggregate unit.

5.1 Identifying real start-ups and exits

From the examples in table 2 it is easy to see that in order to obtain measures of firm dynamics that more accurately reflect real economic changes, predecessors and successors involved in an event have to be removed from the population of administrative entrants and exits. This allows for the identification of real start-ups and exits.

We recall the definition of a real employer start-up according to the Eurostat definition discussed in 3.2: it is an entrant creating new production factors, in particular new jobs; reactivations of dormant firms are not considered as start-ups, neither are entries into the population due to events such as changes of ID number, mergers, break-ups, etc. The latter are denoted as spurious entrants.

Applying this definition to the data set, we identify real start-ups in quarter q using the following algorithm: all individual firm records

- with a positive number of employees in quarter *q*
- *and* with zero employees in all periods before
- *excluding* successors that have been linked to a predecessor in period *q-1 – q* according to the decision rules in Table 1.

The latter group are spurious entrants: newly registered firms which do not start from scratch but to which (a significant part of) the work force of an existing firm is transferred.

Similarly, a real firm exit occurs when a firm exits from the population and its production factors, in particular the jobs, are destroyed; temporary deactivations are not considered as real exits, neither are firm exits due to a change of ID number, take-over, merger etc.

Real employer exits in quarter *q* are identified as: all individual firm records
- with a positive number of employees in quarter *q-1*
- *and* with zero employees in all next periods;
- *excluding* predecessors that have been linked to a successor in period *q-1 – q* according to the decision rules in Table 1.

The latter group are spurious exits: firms of which the ID number is abolished, but of which (a significant part of) the work force is transferred to a new number.

For completeness, we remark that our definition of re/deactivations, computed over the entire period of observation (2005q2 to 2010q2), differs from the one recommended by Eurostat, which is based on a period of two years.

As will be shown below, 43 per cent of all administrative entrants with more than 5 employees are spurious entrants, and 44 per cent of all administrative exits with more than 5 employees are spurious exits. Especially in size classes above 20 employees, most administrative entrants and exits do not correspond to the real start-up or exit of an employer firm.

5.2 Adjusting measures of job creation and destruction

The quality of measures of job creation and destruction depends on the correct identification of start-ups and expanding firms (involving job creation) and of exits and contracting firms (involving job destruction). Although it is well understood how failures in the longitudinal linking of firm records induces a bias in statistics on firm and employment dynamics (Abowd and Vilhuber, 2005; Brandt, 2004), most national and comparative studies do not take into account this information when constructing job creation and destruction statistics. Once the links between firm records have been reconstructed, computing job reallocation measures that correspond to the real creation and destruction of jobs, becomes straightforward.

In order to compute measures of real job creation and destruction in a given period, we make use of the notion event. An event contains all firms of which the records have been linked in the 4 quarters of a given period, that is between quarter two of year *t-1* and *t*. Firms that are involved in an event, are removed from the population in the period concerned and replaced by their aggregate event-unit. Employment at the level of such an event is simply the sum of employment of the firms involved. The events are further treated as ordinary firms in the calculation of job creation and destruction measures.

It can easily be seen from the examples in Table 2 that job reallocation calculated at the level of events more accurately reflects real employment dynamics. In example 1, the event-unit represents 20 jobs in both quarter *q-1* and quarter *q*, which yields zero job creation and destruction. The event-unit in example 2 represents 120 jobs quarter *q-1* and 130 in quarter *q*, resulting in the creation of 10 jobs.

Total employment in the period concerned, is not affected by these manipulations, neither is net employment growth. Some caution is required, however, when calculating statistics in subpopulations, such as sectors or regions, since firms involved in one and the same event might belong to different subpopulations. We overcome this problem by assigning the characteristics of the largest firm to the event-unit, both at the beginning (quarter two of year *t-1*) and the end (quarter two of year *t*) of the period concerned.

Although only a minor fraction of employers (1.4%) is involved in an event, overall job creation and destruction measures are strongly revised downward after correction. This is because the firms involved in an event are relatively large on average. In section 6, we look at common indicators of job creation and destruction and illustrate the impact of the record linking method.

5.3 Types of changes in firm structure

An interesting additional application of the employee flow method for economic research is that predecessor-successor relationships can be used for the identification of various types of firm restructuring. We briefly illustrate this below.

Remember that firm *i* and *j* are involved in a predecessor-successor relationship if they share a significant part of the work force in a given period (quarter *q-1* and *q*). A distinction can be made between various types of changes in firm structure taking into account different criteria such as the number of predecessors and successors involved in one event, the relative size of the employee cluster, and whether the predecessor and successor are continuing firms or not. Table 3 presents a possible classification of events. Table 4 summarizes the results in the period of observation.

Table 3 Types of firm restructuring

1 predecessor ~ 1 successor		
	1 entrant	*1 continuation*
1 exit	ID change (G1)	Takeover (G2)
1 continuation	Split-off of part (G3)	Transfer of activities (G4)
n predecessors ~ 1 successor		
	1 entrant	*1 continuation*
n exits	Merger (G2)	Takeovers (G2)
n continuations	Merger of parts (G2)	Transfer of activities (G4)
1 predecessor ~ n successors		
	n entrants	*n continuations*
1 exit	Split-up (G3)	Split-up and takeover of parts (G3)
1 continuation	Split-off of part (G3)	Transfer of activities (G4)
n predecessors ~ m successors		
n exits and m entrants	ID changes + Transfers of activities (G5)	
n and m continuations	Transfer of activities (G4)	
1 to n-1 exits and 1 to m-1 continuations	Combination of split-off, takeover, transfer of activities (G5)	

A major part of events (42%) consist of a combination of one exit and one entrant of firms which share at least half of the work force (G1). Such links mainly correspond to a change of firm identifier (G1). The second largest category (28%) are mergers and takeovers (G2). A merger corresponds to an event where the entire (or part of the) work force of several predecessors is combined into one new entrant. A takeover is an event where the predecessor exits, and a significant part of the work force is transferred to a firm that already existed before. Most events in G2 are one-to-one takeovers (86%). A third group (19%) corresponds to split-offs and break-ups, occurring when a significant part(s) of the work force of an existing firm is transferred to a newly created business number (G3). Again, most of these event are one-to-one relations, i.e. a split-off of part of the work force of a continuing firm (91%). A small group of events (5%) consist of links between two or more continuing firms which interchange a significant part of the work force. Such transfers of activities mainly occur between ID numbers of firms belonging to one and the same company group. A final small group consist of events involving a more complex combination of employee flow linkages between different firms, often occurring as a series of successive quarterly linkages within one annual period.

Table 4 Number of events by type of firm restructuring; Belgian employer firms, 2005q2 – 2010q2.

		2005-06	2006-07	2007-08	2008-09	2009-10	Annual average	Share in all events
G1	ID change	682	693	637	606	617	647	0.42
G2	Merger, take-over	346	359	452	517	482	431	0.28
G3	Break-up, split off	311	329	327	279	220	293	0.19
G4	Transfer of activities	79	79	79	83	87	81	0.05
G5	Combination	80	74	72	64	84	75	0.05
Total		1498	1534	1567	1549	1490	1528	1.00
Total number of firms in event		3247	3174	3116	2995	2807	3068	
Share in all firms		0.015	0.015	0.014	0.014	0.013	0.014	

Source: NSSO – CES-KU Leuven

6 Impact on start-ups, exits, and job creation and destruction

In this section we present the impact of the employee flow approach on common measures of firm and employment dynamics. We compare 'administrative' statistics, based on the raw administrative data, with more realistic measures obtained after broken firm linkages have been repaired.

6.1 Firm dynamics

6.1.1 Employer start-ups and exits

As explained in section 3, we follow the Eurostat / OECD recommendations for the definition of employer start-ups and exits. They are denoted as *real* start-ups and exits. Other administrative entrants not meeting this definition are denoted as *spurious* start-ups and exits. Table 5 reports the results. To clearly illustrate the impact of the employee flow approach, the results are restricted to start-ups and exits of firms with more than 5 employees. Since 5 employees is the minimum threshold that is set for identifying clustered employee flows between firms, the correction has no impact on smaller firms. In view of international comparison, we also restrict the scope of the data to firms in sector B to N of the NACE Rev. 2 classification. Thus firms in manufacturing, construction, trade, and private services are covered, but agriculture, public administration, and public services such as education and health services are not.

Table 5 Number of employer start-ups and exits; Belgium, employer firms with 5 employees or more, NACE Rev. 2 B to N, 2006q2-2011q2

	Start-ups			Exits		
	Administrative	Real	*Difference*	Administrative	Real	*Difference*
	n	n	%	n	n	%
2006-07	2309	1303	*-43.6*	2261	1241	*-45.1*
2007-08	2264	1331	*-41.2*	2322	1299	*-44.1*
2008-09	1928	1101	*-42.9*	2561	1472	*-42.5*
2009-10	1891	1105	*-41.6*	2454	1399	*-43.0*
2010-11	1933	1094	*-43.4*	2392	1366	*-42.9*

Source: NSSO – CES-KU Leuven

In all years of observation, the number of firm start-ups is strongly reduced after applying the employee flow method: on average 43% of administrative firm entrants with more than 5 employees do not correspond to the real start-up of an employer firm, but results from a change in firm identifier or a restructuring event. Similarly, on average 44% of administrative firm exits are not real exits, but firms which change ID number or are taken over by another firm.

Not surprisingly, as the size of the entrant or exit increases, it becomes more unlikely that it corresponds to the real start-up or exit of an employer firm. This is illustrated in Table 6.

Table 6 Number of employer start-ups and exits by size; Belgium, NACE Rev. 2 B to N, average 2006-2011

	Start-ups			Exits		
	Administrative	Real	*Difference*	Administrative	Real	*Difference*
	n	n	%	n	n	%
Size (number of jobs)						
5-9	1263	869	*-31.2*	1337	926	*-30.7*
10-19	493	229	*-53.5*	580	282	*-51.4*
20-49	222	75	*-66.4*	340	119	*-64.8*
50-99	50	11	*-77.4*	86	21	*-75.6*
100-249	25	2	*-92.1*	39	6	*-84.6*
250-499	7	0	*-100.0*	10	1	*-88.0*
500+	6	0	*-100.0*	6	0	*-100.0*
All sizes (1+)	17354	16450	*-5.2*	17155	16079	*-6.3*

Source: NSSO – CES-KU Leuven

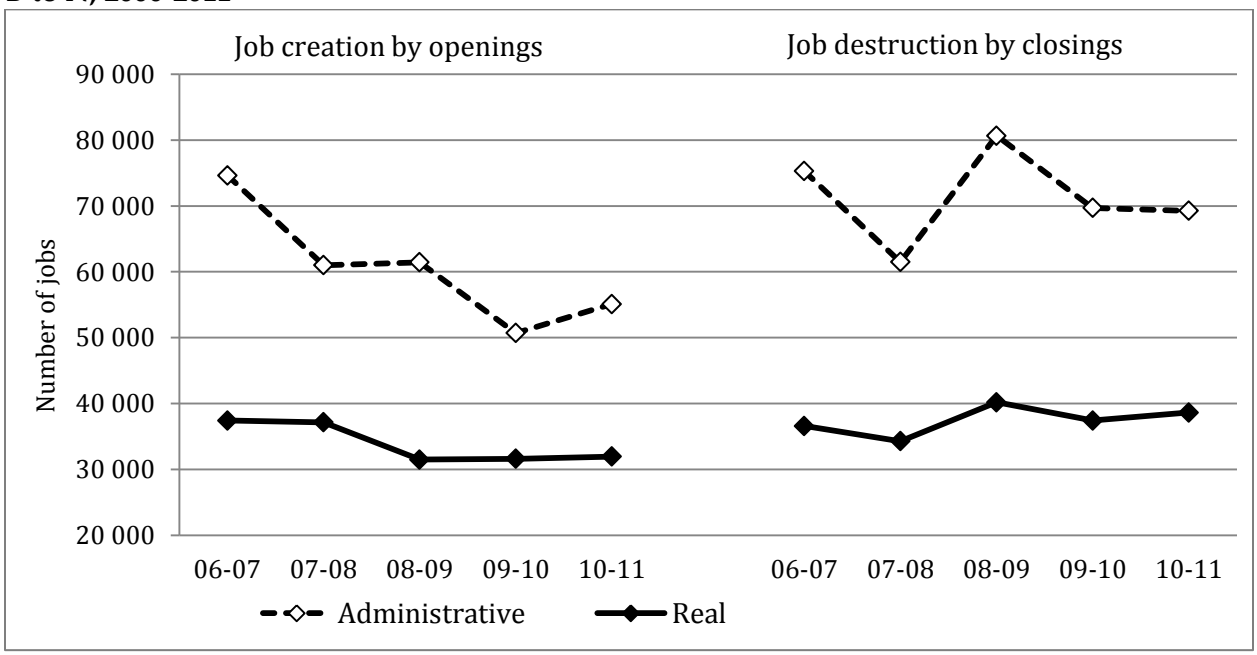
Of all administrative entrants with 5 to 9 employees, almost one in three is a spurious entrant emerging from an existing firm (31.2%). Above the threshold of 100 jobs, it is highly unlikely that a new entrant coincides with a real start-up: out of the 38 administrative entrants with more than 100 employees which are, on average, registered every year, only two correspond to the

real start-up of a firm actually creating new employment. The exit population shows a similar pattern. Of all employer ID numbers disappearing from the data set and employing 5 to 9 employees in the year of exit, on average 30% do not correspond to the real exit of a firm. Large exits are somewhat more likely than large start-ups, but still the vast majority of administrative exits of medium and large employers are spurious exits. The last row in Table 6 reports the impact on total start-ups and exits of all sizes. Given the small share of firms with more than 5 employees in total firm entries and exits, only a small difference exists between the administrative and employee flow approach.

6.1.2 Job creation by start-ups and job destruction by exits

Although spurious employer start-ups make up only a small share of total administrative entrants, they represent a disproportionately large share of total employment of administrative entrants and thus induce a strong upward bias in job creation measures. The same goes for job destruction by exit firms. This is where the importance of the employee flow method becomes clear. Figure 1 compares annual estimates of job creation and destruction by administrative and real start-ups and exits.

Figure 1 Job creation and destruction by employer start-ups and exits, Belgium, NACE Rev. 2 B to N, 2006-2011



Source: NSSO – CES-KU Leuven

Annual job creation by new entrants on the basis of administrative data ranges from 50 000 to 75 000 jobs in the period of observation. Between 38% and 50% of this apparent job creation is, however, associated with spurious start-ups. After identifying real start-ups, annual job creation

is revised downward to a range of 31 000 to 37 000 jobs. Not only the level is considerably lower, also annual variation is strongly reduced. The result is a relatively stable number of jobs created by start-ups every year, which certainly is a more realistic picture of the contribution of firm start-ups to employment in the period considered.

The effect on job destruction of separating out spurious exits is similar. Administrative job destruction by exit is decreases by more than 45%, and annual variation is considerably reduced. This results in a relatively stable picture of annual job destruction by exiting firms. Persson (1998) and Korkeamäki and Kyyrä (2000), studying the impact of an employee flow approach using Swedish and Finnish data respectively, report equally high impacts of spurious start-ups and exits on estimates of job creation and destruction.

The reduction of annual variation is of particular importance when studying trends of job creation and destruction in different sectors. At sector level, the appearance of only a few spurious start-ups or exits may strongly distort job flow measures. Below we illustrate the impact of the employee flow method on sectoral job reallocation measures by some examples.

6.2 Job creation and destruction

6.2.1 Overall measures

Finally, we turn to the impact of the employee flow approach on measures of job creation and destruction. In Table 7, administrative and real measures are compared: both absolute numbers and rates of job creation and destruction are reported.

The employee flow method reveals a strong upward bias in job reallocation measures based on administrative data. In the five years of observation, on average 20% of registered job creation and 22% of registered job destruction does not reflect the real creation and destruction of employment. A large part is accounted for by spurious firm start-ups and exits, as illustrated above. The other part is due to firm restructurings, such as firms taking over (parts of) other firms, mergers, split-offs, or (often merely administrative) transfers of activities between firm identification numbers.

Rates of job creation and destruction allow the comparison of results across sectors and countries (for definitions see §3.3). These rates are reduced by 1.6 to 2.5 percentage points after correcting for spurious job dynamic, as is shown in the lower panel of Table 7. This results in real average job creation and job destruction rates of 7.4% and 6.5% respectively in the period of observation.

Table 7 Total job creation and destruction; Belgium, NACE Rev. 2 B to N, 2006-2011

	Job creation			Job destruction			Net growth
	Administrative	Real	*Difference*	Administrative	Real	*Difference*	
	n	n	%	n	n	%	n
2006-07	239412	182247	*-23.9*	195427	138262	*-29.3*	43985
2007-08	223110	186998	*-16.2*	171136	135024	*-21.1*	51974
2008-09	188235	140150	*-25.5*	239201	191116	*-20.1*	-50966
2009-10	197468	161784	*-18.1*	183727	148043	*-19.4*	13741
2010-11	209629	171190	*-18.3*	172979	134540	*-22.2*	36650
Annual avg.	211570.8	168473.8	*-20.4*	192494	149397	*-22.4*	19077

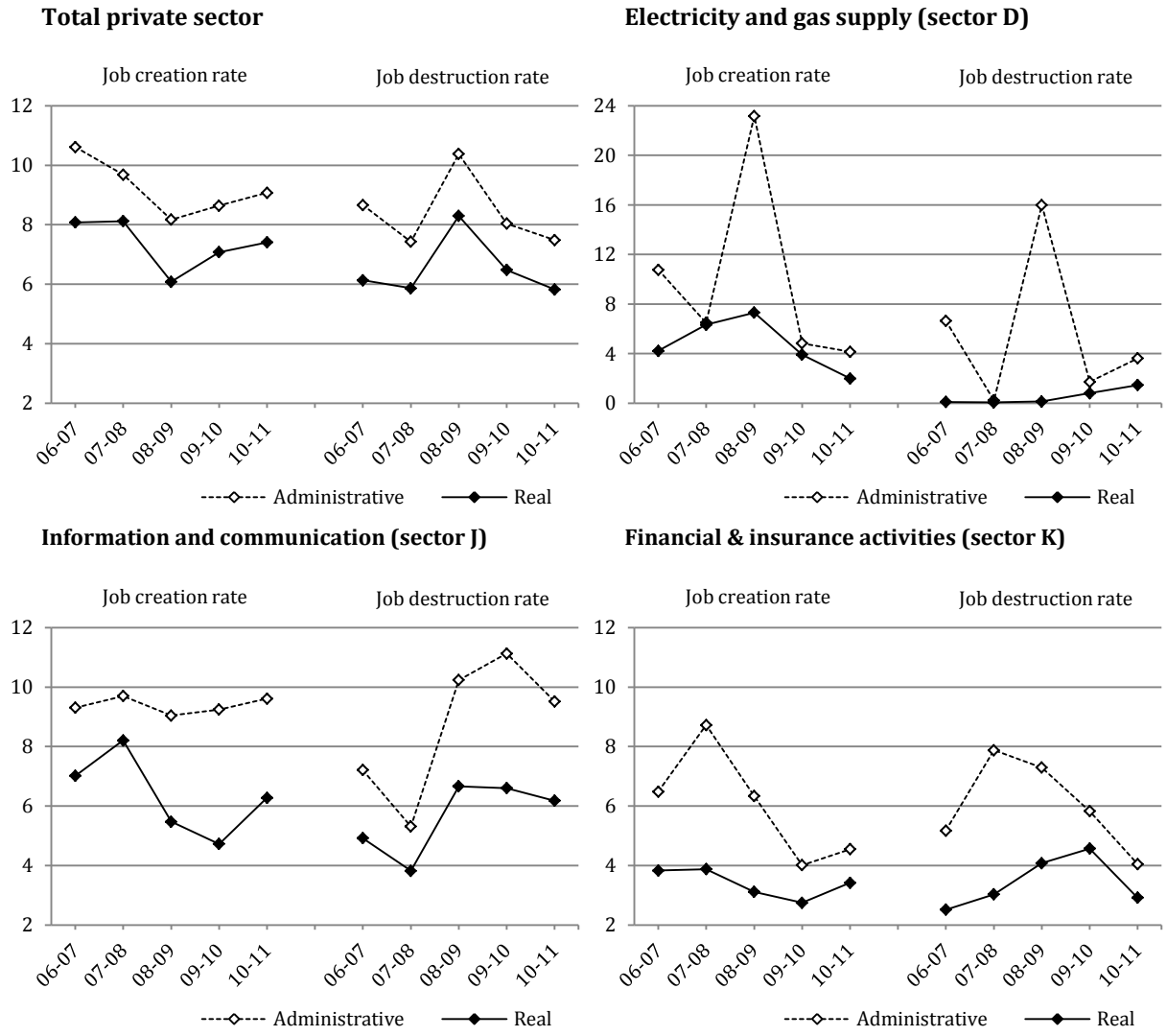
	Job creation rate			Job destruction rate			Net growth rate
	Administrative	Real	*Difference*	Administrative	Real	*Difference*	
	%	%	*ppt*	%	%	*ppt*	%
2006-07	10.6	8.1	*-2.5*	8.7	6.1	*-2.5*	1.9
2007-08	9.7	8.1	*-1.6*	7.4	5.9	*-1.6*	2.3
2008-09	8.2	6.1	*-2.1*	10.4	8.3	*-2.1*	-2.2
2009-10	8.6	7.1	*-1.6*	8.0	6.5	*-1.6*	0.6
2010-11	9.1	7.4	*-1.7*	7.5	5.8	*-1.7*	1.6
Annual avg.	9.2	7.4	*-1.9*	8.4	6.5	*-1.9*	0.8

Source: NSSO – CES KU Leuven

6.2.2 Sectoral estimates

The impact of the employee flow method on job flow measures broken down by sector is presented in Table A.4 in annex. Figure 3 illustrates some examples. In line with the general observations discussed above, job creation and destruction rates are considerably revised downward after correcting for spurious job reallocation, and annual variation is significantly reduced. Sectoral results based on administrative data show unrealistic peaks in annual job flow rates, which are strongly reduced after correction. It may be clear that the more detailed the sector category, the larger the share of individual firms in total sectoral employment, and hence the stronger the bias in sectoral measures caused by a few employee flow events.

Figure 2 Some examples of sectoral job creation and destruction rates; Belgium, 2006-2011



Source: NSSO – CES KU Leuven

One could expect that sectors with traditionally high job reallocation levels would be affected more by the presented method, hence resulting in less variation in job reallocation rates between sectors. The explanation would be that changes in firm identifier and/or firm restructurings would be more frequent in particular sectors, yielding artificially high dynamic measures. This appears not to be the case. Traditional differences in sectoral dynamics remain unaffected by the presented method. For example, very turbulent sectors, such as construction (NACE F), hotel and restaurant sector (NACE I) and business services (NACE N), have the highest job reallocation rates both before and after correction. Also the difference between low job creation and destruction rates in manufacturing and high rates in services is unchanged. In other words, spurious events seem to be randomly distributed across sectors.

7 Discussion

Observation of clustered employee flows between firm records reveals information about longitudinal histories of firms which otherwise remains hidden in administrative data. This makes it possible to construct more accurate statistics on firm and employment dynamics.

The main shortcoming of the employee flow method is that it cannot be adopted to small firms or to changes in firm structure involving a small number of employees. Hence, the method does not provide a criterion to distinguish between real and spurious dynamics in small firms. More specifically, in this paper, changes involving flows of less than 5 employees are not taken into account. The reason why we do not use a lower cut-off level, is because we believe that flows of less than 5 employees might include many cases of individual employees simply changing jobs.

Therefore, the employee flow method should be complemented with other approaches. In view of this, we started collaboration with Statistics Belgium which has developed a national method for longitudinal linking of firm records in the frame of the European Structural Business Statistics, a statistical product of EUROSTAT. This national method follows the European recommendations of the "Eurostat-OECD Manual on Business Demography Statistics" (Eurostat/OECD 2007) and consists of two parts. First, information is used from additional administrative sources providing data about firm restructurings, ownership structure, VAT units, and social security declarations. Second, a probabilistic matching procedure is followed which links firm records based on a correspondence on industry, name and address.

8 Conclusion

Overestimation in measures of firm and employment dynamics, based on large administrative data sets, is well understood. Missing links between different identifiers of one and the same employer, and between firms involved in a restructuring, results in an upward bias in dynamics statistics. Commonly applied methods to address these problems use probabilistic matching based on similarities in partial firm identifiers. Such matching techniques, however, require careful manual review and do not fully capture firm restructuring events. More recently, alternative linkage methods are being developed which are based on employee flows between firms. These methods allow more effective longitudinal linking and are easily reproducible.

In keeping with this novel approach, this paper presents a method for the longitudinal linking of firm records by using employee flow information. The method makes use of information on

clustered flows of at least 5 employees between firm records. The established links between firms allow for a more accurate identification of employer start-ups and exits, of real job creation and destruction, and of firm restructuring events. Taking advantage of the possibilities of a linked employer-employee data set covering all private employment in Belgium, the method was developed on the basis of a limited number of years (2005-2010). The results have led to the creation of a longitudinal linked employer-employee data set in Belgium and the DynaM project www.dynam-belgium.org which publishes accurate national statistics on firm and employment dynamics on an annual basis.

The main advantage of the presented method is that a substantial quality improvement of statistics on firm and employment dynamics can be reached by using simple algorithms. Not only are the results easily reproducible, they also meet the Eurostat/OECD definitions agreed in an internationally harmonized framework on business demography. By using the continuity of the firm's workforce as a main criterion for the continuity of the firm, employer start-ups and exits can be identified that closely correspond to the real creation of new factors of production or the real destruction of existing ones. An additional application of the employee flow method is the identification of firm restructuring events, such as mergers, acquisitions, and split-offs, and the employment dynamics involved.

The impact of the method on common measures of firm and employment dynamics is illustrated by making use of annual data of a 5-year period (2006-2011). The main conclusion is that the presented method yields a significant reduction of the upward bias in statistics of firm dynamics and of job reallocation. In the period of observation, we find that more than 40% of registered entrants and exits with more than 5 employees do not coincide with the real start-up or exit of an employer firm. These 'spurious events' represent a disproportionately large share of employment creation and destruction and hence induce a strong upward bias in job flow measures. Total annual job creation by newly born firms of all sizes is reduced by more than 40% after correction, and annual job destruction by exits is equally adjusted. Overall job creation and destruction levels are strongly revised downwards as well, i.e. by 20% and 22% respectively. To conclude, levels of firm and employment dynamics turn out to be considerably lower than is generally concluded on the basis of administrative data.

A second conclusion is that annual variation in firm and employment dynamics is substantially smaller than it appears from administrative data. Raw data often show strong annual fluctuations, both in the number of start-ups and exits and in job creation and destruction levels. These are considerably flattened out after correction, revealing much more regular annual patterns in firm and employment dynamics. This is particularly true at sector level, where administrative data often report unrealistic annual leaps.

In summary, we conclude that the use of plain administrative data may induce a considerable bias in statistics on firm and employment dynamics, especially when sector-specific patterns are considered. Applying the employee flow approach to re-establish missing links between firm records results in overall lower levels of start-ups, exits and job reallocation, as well as smaller variation between years and within sectors.

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Annex

Table A.1 Classes of employees linked to firm *A* in quarter q1 and q2 – hypothetical example

Quarter *q1*		Quarter *q2*		Employee class
Firm identification number	Firm identification number	Employer identification number	Employee identification number	
A	001	A	001	(1)
A	002	A	002	(1)
A	003	A	003	(1)
A	004	A	004	(1)
A	005	A	005	(1)
A	006	B	006	(2)
A	007	B	007	(2)
A	008	B	008	(2)
A	009	C	009	(2)
A	010	-	010	(3)
D	011	A	011	(4)
-	012	A	012	(5)
-	013	A	013	(5)

(1) employees employed by firm *A* in both quarters
(2) employees employed by *A* in *q1* and by another firm in *q2*
(3) employees employed by *A* in *q1* and by no NSSO employer in *q2*
(4) employees employed by another firm in *q1* and by *A* in *q2*
(5) employees employed by no NSSO employer in *q1* and by *A* in *q2*

Table A.2 Number record linkages in 20 quarters of observation; Belgian employer firms, 2005q2 –2010q2.

	2005-06	2006-07	2007-08	2008-09	2009-10	Annual average	Share in all links
1. Predecessors exits and successor enters (ID change)							
Total	**828**	**864**	**811**	**780**	**765**	**810**	**0.44**
a) cluster >= 50% of both firms	817	859	807	766	752	800	0.43
b) not in a) and cluster >= 30 employees	11	5	4	14	13	9	0.01
2. Predecessor and successor continue							
Total	**64**	**83**	**68**	**66**	**71**	**70**	**0.04**
a) cluster >= 50% of both firms	43	43	35	37	44	40	0.02
b) not in a. and cluster >= 30 employees	21	40	33	29	27	30	0.02
3. Predecessors continues, successor enters (Split-off)							
Total	**403**	**415**	**404**	**365**	**296**	**377**	**0.20**
a) cluster >= 50% of both firms	160	169	148	131	105	143	0.08
b) not in a) and cluster >= 75% of successor	213	218	239	204	170	209	0.11
c) not in b) and cluster >= 10 employees and >= 50% of successor	19	23	13	17	18	18	0.01
d) not in c) and cluster >= 30 employees	11	5	4	13	3	7	0.00
4. Predecessor exits, successor continues (Takeover)							
Total	**499**	**484**	**598**	**676**	**666**	**585**	**0.32**
a) cluster >= 50% of both firms	145	129	193	242	219	186	0.10
b) not in a) and cluster >= 75% of predecess.	322	319	366	414	399	364	0.20
c) not in b) and cluster >= 10 employees and >= 50% of predecessor	23	19	25	16	30	23	0.01
d) not in c) and cluster >= 30 employees	9	17	14	4	18	12	0.01
Total number of links	**1794**	**1846**	**1881**	**1887**	**1798**	**1841**	**1.00**
Total number of linked firms	3247	3174	3116	2995	2807	3068	
Share in all firms	.015	.015	.014	.014	.013	.014	

Source: NSSO – CES-KU Leuven

Table A.3 Job creation and destruction rates by employer start-ups and exits; Belgium, NACE Rev. 2 B to N, 2006-2011

	Job creation rates by start-ups		Job destruction rates by exits	
	Administrative	Real	Administrative	Real
	%	%	%	%
2006-07	3.3	1.7	3.3	1.6
2007-08	2.6	1.6	2.7	1.5
2008-09	2.7	1.4	3.5	1.7
2009-10	2.2	1.4	3.0	1.6
2010-11	2.4	1.4	3.0	1.7

Source: NSSO – CES-KU Leuven

Table A.4 Sectoral job creation and destruction rates; Belgium, NACE Rev. 2 B to N, 2006-2011

		Job creation rate					Job destruction rate				
		2006-07	2007-08	2008-09	2009-10	2010-11	2006-07	2007-08	2008-09	2009-10	2010-11
		%	%	%	%	%	%	%	%	%	%
Total	Administrative	10.6	9.7	8.2	8.6	9.1	*8.7*	*7.4*	*10.4*	*8.0*	*7.5*
	Real	*8.1*	*8.1*	*6.1*	*7.1*	*7.4*	*6.1*	*5.9*	*8.3*	*6.5*	*5.8*
Mining	Administrative	3.2	3.2	13.6	2.1	4.1	3.2	16.9	4.4	4.8	4.8
(sector B)	*Real*	*3.1*	*3.2*	*12.9*	*2.1*	*2.8*	*3.0*	*16.9*	*3.7*	*4.8*	*3.5*
Manufacturing	Administrative	7.7	5.9	4.4	4.7	6.0	8.5	5.4	9.4	8.0	6.4
(sector C)	*Real*	*4.6*	*4.8*	*2.7*	*2.9*	*4.3*	*5.4*	*4.2*	*7.7*	*6.2*	*4.7*
Electricity and gas supply	Administrative	10.8	6.5	23.2	4.8	4.1	6.6	0.2	16.0	1.7	3.6
(sector D)	*Real*	*4.2*	*6.3*	*7.3*	*3.9*	*2.0*	*0.1*	*0.1*	*0.1*	*0.8*	*1.5*
Water supply and waste	Administrative	10.9	7.6	5.0	4.8	6.4	6.0	3.8	6.0	5.4	4.1
management (sector E)	*Real*	*8.1*	*6.6*	*4.1*	*3.8*	*5.4*	*3.3*	*2.8*	*5.1*	*4.5*	*3.0*
Construction	Administrative	13.6	12.8	10.4	11.2	12.0	10.4	10.5	11.6	10.9	10.5
(sector F)	*Real*	*12.0*	*11.4*	*9.2*	*9.8*	*10.7*	*8.9*	*9.1*	*10.5*	*9.5*	*9.2*
Wholesale and retail trade	Administrative	10.2	9.6	8.0	8.3	8.9	8.2	8.2	8.5	7.7	7.7
(sector G)	*Real*	*8.2*	*8.0*	*6.7*	*7.1*	*7.4*	*6.3*	*6.7*	*7.2*	*6.4*	*6.2*
Transport and storage	Administrative	7.9	7.4	5.4	5.0	5.5	7.2	6.0	7.2	6.4	6.2
(sector H)	*Real*	*5.6*	*6.0*	*3.9*	*3.7*	*4.5*	*4.9*	*4.7*	*5.7*	*5.1*	*5.2*
Hotels and restaurants	Administrative	17.8	18.9	17.1	18.7	17.4	17.4	17.7	17.8	16.7	16.5
(sector I)	*Real*	*16.5*	*16.9*	*15.4*	*16.6*	*15.8*	*16.0*	*15.6*	*16.1*	*14.6*	*14.9*
Information and	Administrative	9.3	9.7	9.0	9.2	9.6	7.2	5.3	10.2	11.1	9.5
communication (sector J)	*Real*	*7.0*	*8.2*	*5.5*	*4.7*	*6.3*	*4.9*	*3.8*	*6.7*	*6.6*	*6.2*
Financial and insurance	Administrative	6.5	8.7	6.3	4.0	4.5	5.2	7.9	7.3	5.8	4.0
activities (sector K)	*Real*	*3.8*	*3.9*	*3.1*	*2.7*	*3.4*	*2.5*	*3.0*	*4.1*	*4.6*	*2.9*
Real estate activities	Administrative	11.7	13.8	10.2	10.5	11.1	7.6	9.5	9.7	9.1	9.7
(sector L)	*Real*	*11.4*	*12.4*	*9.8*	*10.0*	*10.6*	*7.3*	*8.1*	*9.3*	*8.7*	*9.2*
Professional, scientific and	Administrative	13.3	13.3	10.2	9.0	10.1	9.4	8.3	9.1	8.8	7.9
technical activ. (sector M)	*Real*	*10.5*	*11.1*	*8.1*	*7.4*	*8.5*	*6.6*	*6.1*	*7.0*	*7.3*	*6.3*
Administrative and	Administrative	16.7	17.9	14.8	15.2	16.3	9.5	7.1	7.3	7.2	9.4
support activ. (sector N)	*Real*	*13.6*	*15.9*	*13.3*	*13.6*	*11.7*	*6.4*	*5.1*	*5.9*	*5.6*	*4.8*
Temporary agencies	Administrative	14.4	6.9	7.6	14.2	9.4	7.2	3.8	23.2	1.9	1.3
(sector X)	*Real*	*10.3*	*6.8*	*1.8*	*13.7*	*9.3*	*3.2*	*3.7*	*17.4*	*1.5*	*1.3*

Source: NSSO – CES-KU Leuven